

MIT and Masdar Institute Cooperative Program

MIT works with the [Masdar Institute of Science and Technology](#) to facilitate the development of human capacity in science and technology in Abu Dhabi. As the program continues its second phase, the Masdar Institute is helping to develop a high-caliber workforce focused on research and development that can address grand challenges and underpin economic development in alternative energy and sustainable advanced technologies.

Objectives

For the period July 1, 2015, to June 30, 2016, MIT and the Masdar Institute continued to focus on:

- Developing a robust Masdar Institute research ecosystem for industry and government engagement by having joint researcher-to-researcher projects
- Leveraging the Masdar Institute's signature focus on advanced energy and sustainability to build educational links to industry and assist in selecting new degrees and tracks within existing programs
- Seeding an innovation and entrepreneurship environment in developing research mechanisms to engage industry and developing educational elements to amplify research impact
- Deepening the relationship between MIT and the Masdar Institute by engaging in co-advising of doctoral students, student exchanges, and summer programs for Masdar Institute students at MIT

Academic Programs

The educational mission of the Masdar Institute follows directly from the university's vision and mission. This educational mission is to provide graduate students with the knowledge, skills, and experience necessary for successful careers in industrial or academic roles in their chosen fields and to provide students with domain expertise and broad awareness in advanced energy and sustainable technologies and policies.

The structure of the academic programs is designed to encourage students and faculty to study and research across program boundaries. This enables researchers to tackle complex problems in energy and sustainability that cannot be confined to single disciplines. The nine MS degree programs currently offered at the Masdar Institute have been developed with assistance from MIT. MIT has also assisted with the development of four new concentrations: Technology, Management, Innovation, and Entrepreneurship; Space Systems and Technology; Water Technologies; and Water Resources. MIT has reviewed 125 course electives, and 18 MSc theses, bringing the total of MIT-reviewed theses to 57.

MIT has continued to advise on curricula and the structure of the Masdar Institute's accredited PhD program in interdisciplinary engineering offered by the Department

of Mechanical and Materials Engineering. MIT faculty members are currently serving on more than 72 Masdar Institute PhD students' doctoral committees. At MIT, 249 researchers and 325 MIT students have participated in this collaborative program. MIT has also continued to provide scholarly assessments in the hiring of Masdar Institute faculty.

Students

The Masdar Institute has graduated 512 MSc students and 14 PhD students. The class of 2016 had a total of 120 MSc and PhD graduates, including 46 United Arab Emirates (UAE) nationals and 74 international graduates from 30 countries.

Current Research Activities

The program is committed to building a thriving collaborative research environment, and focuses on three distinct processes that contribute to and support the development of focused research centers at the Masdar Institute.

Masdar Institute and MIT One-to-One Joint Collaborative Research

One-to-one research focuses on the development of capacity in the Masdar Institute faculty and builds a strong relationship between the Masdar Institute and MIT through collaborative research between one MIT principal investigator (PI) and one Masdar Institute PI. Fifty-eight one-to-one projects have been undertaken jointly by MIT and the Masdar Institute. Four new projects were awarded funding in this academic year:

- Mapping Abu Dhabi's Native-Born Neighborhood: Scenario Planning and Design of New Sustainable Neighborhood Forms (MIT Professor Alan Berger and Masdar Institute Professor Khaled Al Awadi)
- Study and Development of Intelligent Multi-Micro-grids with Interactive Capabilities (MIT Professor James Kirtley and Masdar Institute Professor Khaled Al Hosani)
- Fabrication of High Efficiency III-V on Si Photovoltaic Cells Using Advanced Layer Transfer (MIT Professor Jeewan Kim and Masdar Institute Professor Ibraheem Al Mansouri)

Masdar Institute and MIT Flagship Research Projects

The flagship research projects are a mechanism for broader collaborative research between the Masdar Institute and MIT. They are designed to bring together teams of faculty from both institutes to address key strategic research areas, with the intent of building critical mass, making a sizable research impact, and fostering strategic growth of Masdar Institute research centers. Nine flagship projects have been awarded to date; these continued their work over the year from July 1, 2015, to June 30, 2016.

Masdar Institute and MIT Innovation Program

The Masdar Institute and MIT Innovation Program (MMIP) helps MIT and Masdar Institute faculty and students who propose to work jointly to prepare to commercialize

breakthrough technologies and inventions by transforming promising ideas at MIT and the Masdar Institute into innovative products and cutting-edge spinout companies. The MMIP makes modest but pivotal investments in research that is being done by some of MIT's and the Masdar Institute's most talented scientists and engineers. The goal, on completion of MMIP funding, is to attract sufficient investment to commercialize a product and launch a spinout company or to license the technology to an existing company.

Seven so-called Ignition Grants have been awarded to date. The following Ignition Grants were awarded over the year September 1, 2015, to August 31, 2016:

- Electronic Materials for Smart Windows (Professor Mircea Dinca of MIT and Professors Clara Dimas and Ahmad Farrukh of the Masdar Institute)
- Integrated Optical Sensors for Fault Detection in Smart Distribution Systems (Professor James Kirtley of MIT and Professors Hatem Zeineldin and Mahmoud Rasras of the Masdar Institute)
- Transparency-Switching Materials for Reactive Sun Tracking: CPV for the Roof-Top Market (Professor Alfredo Alexander-Katz of MIT and Professor Matteo Chiesa of the Masdar Institute)
- Three Innovation Grants were awarded during the period September 1, 2015, to August 31, 2016:
- GaN High Efficiency Transmitters for Wireless Communication (Professor Tomas Palacios of MIT and Professor Mihai Sanduleanu of the Masdar Institute)
- Wastewater Treatment Using Novel Integrated Technology Based on Bio-Electrochemical and Nanowire Filtration (Professor Jing Kong of MIT and Professor Shadi Hasan of the Masdar Institute)
- Novel Module Configurations for High Efficiency Membrane Distillation (Professor John Lienhard of MIT and Professor Hassan Arafat of the Masdar Institute)

An additional collaborative research project was given an award to pursue pre-commercial research growing out of a prior flagship research project:

- Step Cell for Multi-Junction Silicon Based Solar Cells (Professor Eugene Fitzgerald of MIT and Professor Ammar Nayfeh of the Masdar Institute)

Accomplishments

The MIT and Masdar Institute engagement began in 2006 with MIT's Technology and Development Program. On December 1, 2011, MIT and Masdar Institute Cooperative Program and the Masdar Institute signed a second five-year agreement. A one-year, no-cost extension has been granted to allow the program to continue to November 30, 2017. A new five-year agreement is under consideration.

Over academic year 2016, an additional four MIT faculty members participated in the program (for a total of 123), and 10 additional research scientists or postdoctoral

associates engaged in the program (for a total of 126). These researchers are from 24 different centers, laboratories, and departments at MIT. A posting to Abu Dhabi is not required.

An additional 23 MIT students were supported by the program, raising the number from last year (302) to 325. These students, from 19 different departments, laboratories, and centers, have had funded interactions with Masdar Institute faculty, students, and staff.

MIT students traveled abroad under this program to participate in more than 20 conferences and workshops.

Masdar Institute and MIT participants wrote an additional 194 publications, for a total of 275 to date. MIT participants wrote 162, Masdar Institute participants wrote 43, and MIT and Masdar Institute participants, jointly, wrote 70 publications.

Six additional Masdar Institute faculty members spent from 4.5 to 12 months at MIT, bringing the total number to 65.

MIT interviews all Masdar Institute faculty and senior-level administrators. The current number of Masdar Institute faculty members is 93.

MIT has reviewed and provided scholarly assessment to the Masdar Institute with regard to an additional seven suggested elective courses. If they are adopted, the number of elective courses would rise to 124.

The Masdar Institute has generated \$72,000,805 in externally funded research contracts to date.

The Masdar Institute topped *US News & World Report's* rankings for research in the publication's first listing of best Arab-region universities. The Masdar Institute was ranked first in the field (weighted citation impact list), second in the percentage of total publications in the top 10% category, third in the percentage of total publications in the top 25%, and sixth in the energy subject areas.

The Masdar Institute has filed 125 invention disclosures and has applied for 70 patents; the Institute has 10 issued patents.

Governance of the MIT and Masdar Institute Cooperative Program

Cooperative Program Steering Committee

The Cooperative Program Steering Committee oversees the intellectual and strategic goals of the MIT and Masdar Institute Cooperative Program. The Committee also reviews recommendations of a joint Research Advisory Committee.

The members of the Steering Committee from MIT included Duane Boning, Clarence J. LeBel Professor of Electrical Engineering and Computer Science and director, MIT and Masdar Institute Cooperative Program; Charles Cooney, professor of chemical engineering; Richard Lester, associate provost for international initiatives; and Patricia

Vargas, executive director, MIT and Masdar Institute Cooperative Program. The members from the Masdar Institute include Sultan Al Jaber, UAE Minister of State; Behjat Al Yousef, interim provost, Masdar Institute; Steve Griffiths, vice president for research, Masdar Institute; and Hamza Kazim, vice president, operations and finance, Masdar Institute.

Research Advisory Committee

The Research Advisory Committee reviews all research proposals, monitors progress on research projects, and makes recommendations to the Cooperative Program Steering Committee. Members of the committee from MIT include Robert Armstrong, Chevron Professor of Chemical Engineering and director, MIT Energy Initiative; Munther Dahleh, W. Coolidge Professor of Electrical Engineering and Computer Science, and director, Institute for Data, Systems, and Society; John Lienhard, professor, Mechanical Engineering, and director of the Abdul Latif Jameel World Water and Food Security Laboratory; Eugene A. Fitzgerald, professor, Materials Science and Engineering; and Dr. Duane Boning, Clarence J. Lebel Professor of Electrical Engineering and Computer Science, and director, MIT and Masdar Institute Cooperative Program. Research Advisory Committee members from the Masdar Institute include Mohammad Abu-Zahra, associate professor, Chemical and Environmental Engineering; Rashid K. Abu Al-Rub, professor, Mechanical and Materials Engineering; Steve Griffiths, Professor of Practice, Chemical and Environmental Engineering, and vice president for research; Mohammed Omar, professor, Engineering Systems and Management; and Hatem Zeinelden, professor, Electrical Engineering and Computer Science.

Organization

The director of the MIT and Masdar Institute Cooperative Program is Duane Boning, professor, Electrical Engineering and Computer Science at MIT. Patricia Vargas is the executive director and Peter R. Jones is the assistant director for research. Paul Arsenault is administrative and financial officer, Scott Kennedy is the assistant director for education, Danielle Atwell is the manager of outreach, and Leslie Quinn is the program's administrative assistant.

Duane S. Boning
Director